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# DETERMINATION OF MANPOWER, PERSONNEL, AND TRAINING REQUIREMENTS: A SYNTHESIS OF CASE STUDY FINDINGS (SUMMARY REPORT)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report examines the results of four system case studies, identifies systemic problems with the Army's Human Factors Engineering, Manpower, Personnel and Training requirements determination procedures, in the acquisition cycle, synthesizes findings across the four systems and recommends solutions to identified deficiencies. It addresses concerns being raised about the adequacy and timeliness of the Army's MPT requirements determination procedures.

## EXECUTIVE SUMMARY

### BACKGROUND

Growing concern with the soldier-machine interface problem, the future manpower pool available to the Army, and the Army's ability to make accurate and timely determinations of the quantitative and qualitative Manpower, Personnel, and Training (MPT) requirements for newly developed systems provided the impetus for the study of several emerging materiel systems. This report examines the results of four system case studies, identifies systemic problems with the Army's MPT requirements determination procedures, and recommends solutions to identified deficiencies.

### APPROACH & SCOPE

Official Department of Defense (DOD) and Department of the Army (DA) publications concerning the MPT effort within the system acquisition process were reviewed; earlier and on-going studies were also researched. Specific program data was obtained from interviews with and draft and final MPT documentation prepared by Army materiel developers, combat developers, trainers, testers, manpower planners, personnel managers, and logisticians. Data was assessed within the context of the MPT documents/events identified in the Life Cycle System Management Model (LCSMM), as modified by the specific Program acquisition strategy. Tools and techniques used to determine system MPT requirements were examined

for consistency and reliability. Particular attention was devoted to determining how much emphasis was placed on MPT issues in early requirement and contractual documents for each system studied.

MAJOR FINDINGS

None of the Programs followed the "traditional" acquisition process outlined in the Army's Life Cycle System Management Model (LCSMM). Each bypassed at least one development phase and with it, several MPT events. The case studies provided ample evidence that changes (usually acceleration) in the "standard" acquisition process often delayed and/or degraded the accuracy of MPT requirements estimates and their expression in such documents as the Qualitative and Quantitative Personnel Requirements Information (QQPRI) and Basis of Issue Plan (BOIP).

The QQPRI and BOIP processes are complex, cumbersome, and not well understood by either participants or product users. Decision makers use data generated by both processes to support critical judgments as to system MPT needs. Yet, they are often unaware of how the data were derived and are, therefore, unable to assess its validity/reliability. The developers of the QQPRI and BOIP for any new system are widely separated, organizationally, geographically, and functionally. Therefore, they

often have little understanding of how all the individual bits of data fit together, and lack appreciation of the magnitude of the MPT decisions which must be made on the basis of their inputs to both documents.

- A task and skill analysis and an operational and organization (O&O) concept are essential inputs to the process of determining qualitative manpower requirements for a new materiel system. Case study results indicate that, given these basic ingredients, the system's combat developer (usually a TRADOC proponent school) is in the best position to make qualitative manpower estimates. Findings also support the conduct of some government operational testing prior to a Defense System Acquisition Review Counsel (DSARC) II decision as the most effective means of judging the validity of early qualitative manpower estimates. Modification of predicted qualitative manpower requirements for a major system can be more readily accommodated after DSARC II than following operational testing later in the acquisition process.

Logistic Support Analysis (LSA) and Manpower Authorization Criteria (MACRIT) currently are the primary sources of data elements used to calculate quantitative manpower (especially maintenance) requirements for a major new materiel system. However, manpower planners generally have little confidence in the validity of either LSA data or MACRIT factors. This skepticism is compounded by a lack of definitive procedures for applying the data with either consistency or discipline.

Common to all the case studies was a finding that no consistent methodology exists for ensuring that specific and binding Human Factors Engineering (HFE) criteria are developed, coordinated, and promulgated in Requests for Proposals (RFP) and development contracts for major new materiel systems. Another common weakness noted was that the use of available internal Army HFE expertise (e.g., Human Engineering Laboratory) in guiding and monitoring the design of major new materiel systems is neither mandated nor automatically funded.

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## SECTION I

## BACKGROUND

The Army is currently implementing a broadly based force modernization program featuring the introduction of a large number of sophisticated new materiel systems and simultaneous redesign of its force structure (Division 86). The improvements in these systems offered by new technology are generally accompanied by a corresponding requirement for more highly skilled personnel and concomitant increases in operating and support costs. The modernization process, therefore, is currently placing a heavy demand on limited manpower and training resources. A projected decline in the qualitative and quantitative manpower pool from which the Army must recruit will compound the problem over the next several years. These factors necessitate close and early examination of manpower requirements for materiel systems under development to measure both supportability and affordability.

Specific guidelines have been established for development and acquisition of major systems by the Departments of Defense (DOD) and the Army (DA). The process, a subject of continuous review and analysis, is detailed and involves many management levels. Despite the detail and specificity of documentation and directives governing the acquisition process, problems regarding establishment of manpower and training requirements and system

ownership costs have continued. A number of these problems have been highlighted in previous studies, which gave impetus to this effort.[1] [2] [3] [4] [5]

[1]Betaque, Norman E., Jr., et al. Manpower Planning for New Weapon Systems, WN ML 801-1 through WN ML 801-9. Logistics Management Institute. July - December 1978.

[2]Blanchard, George S. & Kerwin, Walter T., Army Top Problem Areas, Discussion Paper Number 2, "Man/Machine Interface - A Growing Crisis," August 1980.

[3]Bonder, Seth, A Review of Army Force Modernization and Associated Manpower, Personnel, and Training Processes, Working Paper PUTA 81-2, ARI, January 1981.

[4]HQDA, Office of the Chief of Staff, Report: "BOIP/QQPRI Task Force," 9 January 1980.

[5]Rhode, Alfred S., et al, Manpower, Personnel, and Training Requirements for Material System Acquisition, ARI, February 1980.

# SECTION II

# PURPOSE & SCOPE

## A. PURPOSE

This research effort was jointly sponsored by the Defense Systems Management College (DSMC) and the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), under contract MDA 903-81-C-0386. Using a case study approach, the project was designed to accomplish two fundamental objectives.

- o Identify and document deficiencies in the processes/procedures being used to determine manpower, personnel, and training (MPT) requirements for actual Army materiel systems under development; and determine requirements for modifying either the materiel acquisition process and/or MPT requirements determination procedures so as to either correct or mitigate the impact of such deficiencies during development of future systems.
- o Develop didactic materials for use by the DSMC in training and educating system acquisition managers on the need to consider MPT and Human Factors Engineering (HFE) issues at appropriate points in the acquisition process.

This study effort is one of several initiatives which address the adequacy and timeliness of the Army's Manpower, Personnel, and Training (MPT) requirements determination processes and procedures. It supports ARI's intensive systems manning technology research and development program and DSMC's increased educational emphasis on performance of more effective man-machine tradeoffs during early stages of the materiel acquisition process.

## B. SCOPE

Originally, this research was aimed at identifying and analyzing MPT/HFE issues across the entire acquisition process, using the Life Cycle System Management Model[6] as a guide, for each of the following Army materiel systems.

- o AN/TYC-39 Message Switch & AN/TTC-39 Circuit Switch (AN/TTC-39 Program).
- o Multiple Launch Rocket System (MLRS).
- o UH-60A Helicopter (BLACKHAWK).
- o AN/TPQ-36 Mortar Locating Radar & AN/TPQ-37 ,  :illery Locating Radar (FIREFINDER).

During a review of the intermediate results, th  ᴌ ᐣuty Chief of Staff for Personnel (DCSPER), Headquarters, Department of the Army (HQDA), asked that the effort be modified. The DCSPER desired a more in-depth examination of the Army's initial definition of MPT requirements/constraints, and the steps taken by the Army and contractors to accommodate them during the development process. While the basic study objectives remained unchanged, the investigation was expanded accordingly.

The systems selected for study represented a cross section of Army combat development mission areas; e.g., Fire Support (MLRS), Aviation (BLACKHAWK); Tactical surveillance,

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[6]HQDA, Pamphlet No. 11-25, Life Cycle System Management Model for Army Systems, May 1975.

Reconnaissance, and Target Acquisition (FIREFINDER); and Communications (AN/TTC-39 Program). Each had a high development priority and was well along in the acquisition process, thus permitting a more comprehensive examination of actual MPT events and documentation. Availability of U.S. Army Materiel Development and Readiness Command (DARCOM) Program Managers (PM) and U.S. Army Training and Doctrine Command (TRADOC) System Managers (TSM) to interact with study team members also influenced the choice of systems.

This report is one of five resulting from ISI's total research effort. The first four were individual case studies [7] [8] [9] [10] that described, analyzed, and evaluated procedures and data used to determine MPT requirements for specific materiel systems, particularly during early development stages. This report aggregates findings from each of the four case studies, develops conclusions concerning persistent, common deficiencies, and suggests ways for improving the MPT requirements determination process.

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[7] O'Connor, Francis E., et al, MLRS -- A Case Study of MPT Requirements Determination, 30 November 1982.

[8] O'Connor, Francis E., et al, AN/TTC-39 Program -- A Case Study of MPT Requirements Determination, 31 March 1983.

[9] O'Connor, Francis E., et al, BLACKHAWK (UH-60A) -- A Case study of MPT Requirements Determination, April 1983.

[10] O'Connor, Francis E., et al, FIREFINDER -- A Case Study of MPT Requirements Determination, April 1983.

## SECTION III

## SYNTHESIS OF CASE STUDY FINDINGS

### A. MATERIEL ACQUISITION PROCESS

None of the four materiel systems studied followed the "traditional" acquisition roadmap described in the Army's Life Cycle System Management Model (LCSMM). Figure III-1 depicts and compares the acquisition strategies followed during development of the systems examined during this effort.

While deviations from the "standard" process are not inherently damaging to a materiel acquisition program, they can have negative impacts on important aspects of system development, including Manpower, Personnel, and Training (MPT) requirements determination and Human Factors Engineering (HFE). Findings of this study effort indicate that adverse effects are likely to occur unless the acquisition manager positively ensures that --

- o Steps deemed "critical" are identified as such and specifically programmed for accomplishment, even though the LCSMM may show them as occurring in a phase that will be bypassed.
- o the effects of bypassing other "noncritical" steps are identified and weighed; and
- o Changes to the "standard" acquisition cycle are expeditiously communicated to all participants in the process.

ACQUISITION PHASES
PROGRAM START TO IOC

(Approximate Months/Phase)

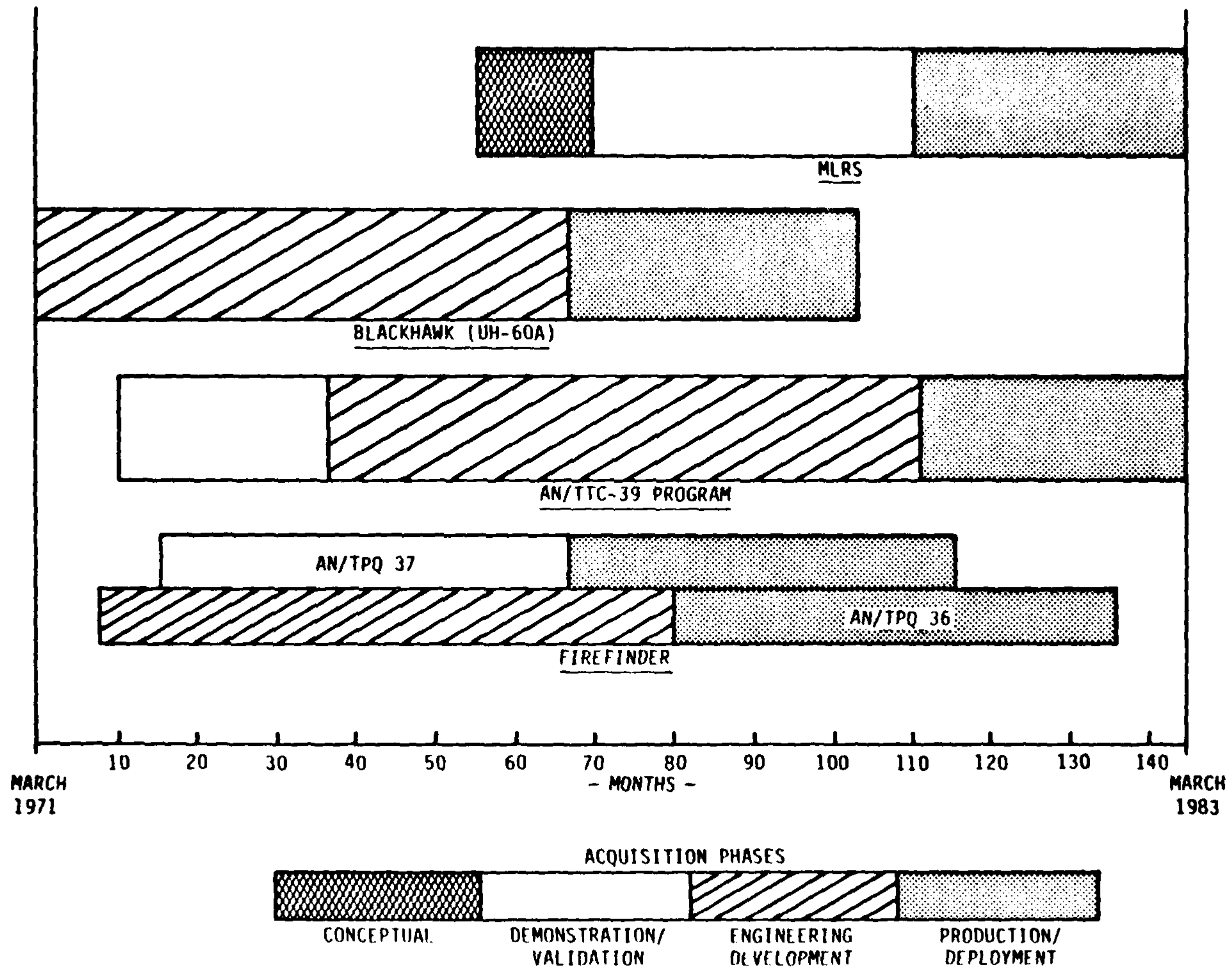


FIGURE III - 1

Some of the systems studied during this effort experienced MPT/HFE-related problems attributable, in part, to LCSMM modifications which either eliminated essential steps or which were poorly communicated to the rest of the acquisition community.

Of the four systems, only MLRS had a formal Conceptual Phase. While the UH-60A Program did not formally proceed through a Conceptual Phase, the military, technical, and economic bases for the system had been examined in some detail before the first milestone (combined Defense System Acquisition Review Council (DSARC) I/II) in May 1971. Both these systems, compared to the AN/TTC-39 and FIREFINDER Programs, benefited from early emphasis on concept definition. Early MLRS and UH-60A system documentation emphasized operational simplicity, reliability, and maintainability, all of which served to influence system design and reduce MPT requirements.

In contrast, the AN/TTC-39 and FIREFINDER Programs immediately entered phases calling for hardware design without definitive guidance concerning Reliability, Availability, and Maintainability (RAM) criteria, and with insufficient appreciation of the impact that advanced technology was going to have on manpower and training requirements. Consequently, HFE had little influence on design of either system, and early MPT requirement estimates were less accurate than those made for the MLRS and UH-60A Programs.

The MLRS, AN/TTC-39, and AN-TPQ-37 acquisition programs had competitive Demonstration/Validation phases. For MLRS and AN/TPQ-37, the phase included Development and Operational Tests (DT/OT-I) as called for in the LCSMM. In the case of the AN/TTC-39 Program, the government only observed while competing contractors demonstrated technical capabilities of prototypes. Direct Army participation in Demonstration/Validation Phase testing of MLRS and the AN/TPQ-37 radar was beneficial to the design and development of both systems. It permitted earlier identification and, therefore, easier resolution of MPT problems and Human Factors Engineering (HFE) deficiencies than was possible with the AN/TTC-39 Program, which did not undergo its first DT/OT until late in the Engineering Development Phase.

The BLACKHAWK (UH-60A) and AN/TPQ-36 Radar development programs formally began with the Full Scale Engineering Development phase. For the UH-60A program, the phase featured competition between two contractors, included key events normally accomplished during the Demonstration/Validation Phase, and ended with Development and Operational Tests (DT/OT II). The AN/TPQ-36 project went directly into Engineering Development with a single contractor. Previous development efforts with a technologically similar radar permitted the program to skip the Conceptual and Demonstration/Validation phases without actually bypassing key events called for in those phases.

Published Army policies and procedures generally assume that new system development will follow the "traditional" sequence of phases/events outlined in the LCSMM, and little formal guidance is provided concerning management of modified (usually accelerated) acquisition programs. Consequently, coordination among acquisition participants representing the HQDA staff, materiel developer, combat developer, personnel community, and contractor(s) becomes particularly critical when the LCSMM for a particular system is changed.

In attempting to track the MPT events which took place during the acquisition of each system under study, a number of common factors, summarized below, were found to hinder the establishment of effective communications and coordination networks within Army materiel development programs; these are exacerbated when the "traditional" LCSMM process is modified.

- The Army acquisition community is not homogeneous; its many and diverse participants have narrow proponency limits and are widely separated organizationally and geographically. (e.g., in the case of the UH-60A, the contractor is in CT; the materiel developer is a DARCOM Subordinate command in MO; the combat developer is a TRADOC Subordinate command in GA; and the TRADOC System Manager is in AL).

- There is no single entity, who can faithfully represent overall Army interests, "in-charge" of the total process. In fact, there is no central management authority for even the manpower and personnel requirement determination subsystems within the overall acquisition process.

- Often, equivalent counterparts either do not exist, or at best, are hard to find in all segments of the complex acquisition community for a given system. Even when counterparts are located, their ability to effectively interact is frequently inhibited by differences among them in the following areas:

oo Experience

oo Training

oo Grade level

oo Authority to speak for the organization represented

oo Program priority within organization represented

oo Assignment stability

During this study, disparities were most often observed in the areas of experience and training between counterparts in the combat development (TRADOC) and materiel development (DARCOM) communities. For example, most of the personnel assigned to TRADOC System Managers' (TSM) Offices had little or no previous materiel development experience or training, whereas the majority of individuals in the Program Managers' (PM) Offices had either significant work experience (mostly civilian) or formal training (mostly military) in the materiel acquisition field. On the basis of many interviews with subject matter experts (SME) during this study effort, it was found that knowledge and experience gaps on top of physical and organizational separation fostered a certain amount of mistrust and misunderstanding among members of the combat and materiel development communities.

## B. DETERMINATION OF MANPOWER REQUIREMENTS

### 1. Qualitative and Quantitative Personnel Requirements Information (QQPRI) and Basis of Issue Plan (BOIP)

The QQPRI and BOIP are iterative documents that provide Army manpower planners the earliest and most current information concerning the numbers and qualifications of personnel required to operate, support, and maintain a materiel system under development. For the majority of acquisition programs, input to both documents comes from a variety of organizational sources within the materiel development (DARCOM) and combat development (TRADOC) communities. A substantial amount of basic data in both documents is derived from Logistics Support Analysis (LSA).

The materiel developer, usually a subordinate Materiel Development (MDC) or Readiness Command (MRC) within DARCOM, e.g., the US Army Missile Command in the Case of MLRS, initiates both the BOIP and QQPRI processes by preparing BOIP Feeder Data (BOIPFD). The BOIPFD lists all principal and associated items of equipment, to include Test, Measurement, and Diagnostic Equipment (TMDE) required to support the new system. The materiel developer also concurrently prepares a proposed QQPRI which lists skills, tasks, and knowledge required to operate and support the new item, and estimates the time required to maintain it at various maintenance levels. Both the BOIPFD and proposed QQPRI are forwarded by the materiel developer through DARCOM channels to TRADOC.

The materiel developer's proposed QQPRI is refined at TRADOC through assessment of the training, support, and doctrinal implications of the new system. Using data from both the QQPRI and BOIPFD along with the Organizational and Operational (O&O) concept, a TRADOC proponent school, e.g., U.S. Army Infantry School in the case of the UH-60A Program, develops the BOIP. The BOIP is a planning document which predicts organizational quantitative equipment and personnel requirements for a system.

Following TRADOC's refinement of the QQPRI and development of the BOIP, both documents are staffed at the Soldier Support Center-National Capital Region (SSC-NCR) and HQDA to determine if the system falls within manpower constraints; reflects the appropriate Military Occupational Specialties (MOS)/Special Qualifications Identifiers (SQI)/Additional Skill Identifiers (ASI); meets Standards of Grade Authorization (SGA); has a feasible grade structure; and can be supported by Army recruiting and training capabilities.

As a materiel system proceeds through the development process, the QQPRI and BOIP must be updated to reflect the latest outputs from LSA and other events which feed the BOIP and QQPRI. These two documents, among others, are also prerequisites for the decision to type classify new Army materiel as standard. The interrelated QQPRI and BOIP processes are summarized graphically at Figure III-2.

## QQPRI-BOIP PROCESSING

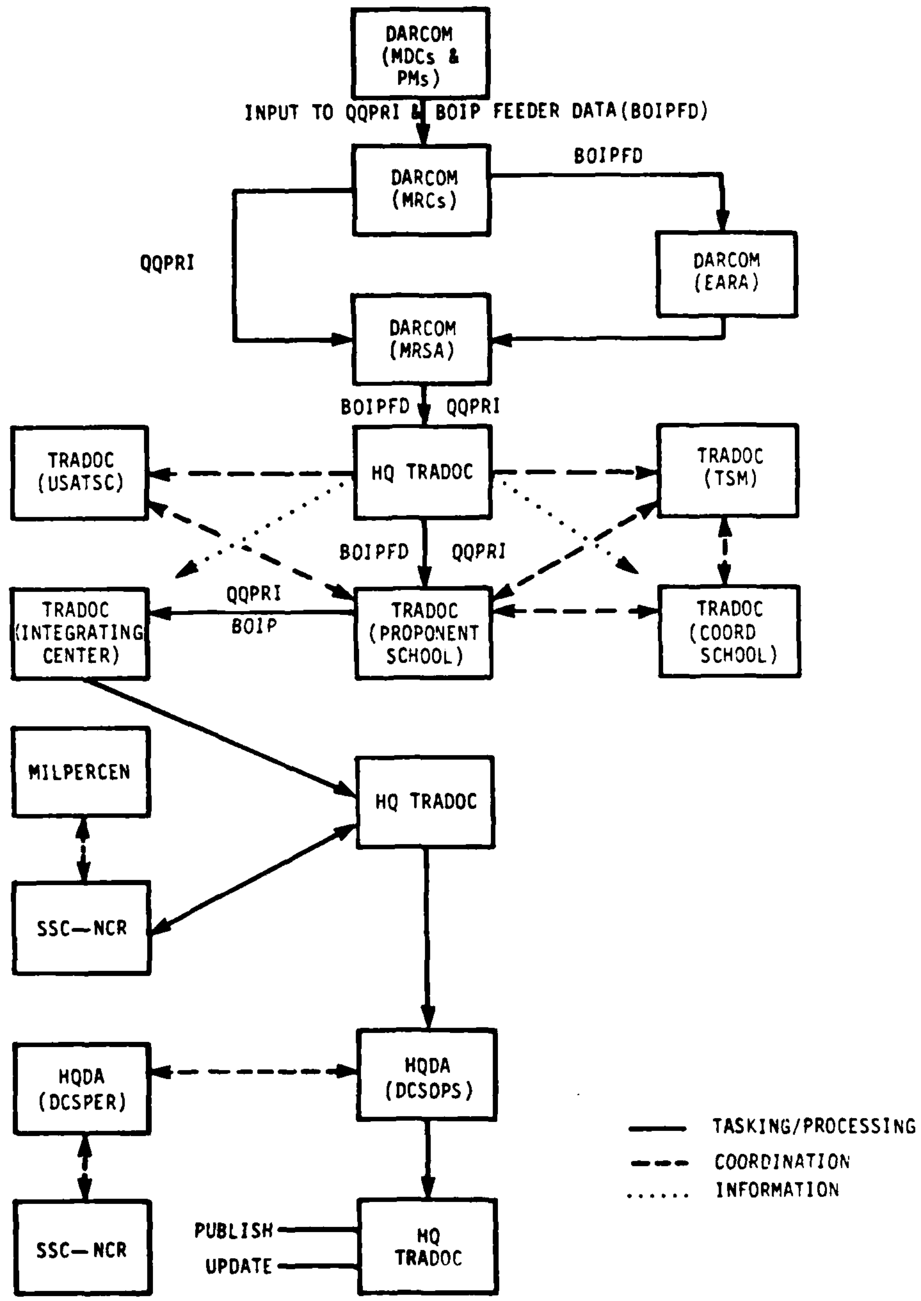


FIGURE III - 2

As suggested by Figure III-2, and confirmed during this study effort, the manpower requirements documentation (QQPRI/ BOIP) process is cumbersome. The channels and agencies through which the documentation must flow are lengthy, complicated, and generally not automated. Given the complexity of the process and the number of vertically stove-piped organizational levels required to either review or act on the documentation, it is natural to find that the process is not well understood. This contributes to a large number of procedural errors and sometimes gross inaccuracies in the development and expression of requirements. A subject matter expert at the US Army Materiel Support Activity (MRSA), DARCOM's clearinghouse for QQPRIs & BOIPFDs, indicated that about 30 percent of QQPRIs and BOIPFDs must be returned to the orginating MDC/MRC either for correction of errors or inclusion of data omitted in the initial submission.

A revised Army Regulation (AR) 71-2 (BOIP/QQPRI) effective July 1982, has improved the processes by consolidating guidance for preparation of both documents, simplifying definitions, and clarifying some of the procedures. Despite these improvements, common case study findings indicate that some fundamental problems with the processes remain; these are summarized below.

- The Army's personnel community does not become actively involved in the QQPRI/BOIP processes until some 6 months into the review process, i.e., when the SSC-NCR formally receives the documents from TRADOC Headquarters.

- The QQPRI procedures make the materiel developer (usually a DARCOM Subordinate Command) responsible for selecting current, revised or new MOSs for operation and maintenance of the new system. The materiel developer is in neither a functional nor an organizational position to know all the dynamics affecting selection of MOSs and, therefore, is ill equipped to provide that input. The combat developer (usually a TRADOC proponent school) is in a much better position to make such judgements.

- Procedures call for the combat developer (TRADOC) to comment on the materiel developer's manpower proposals. Often, these "comments" are not fed back to the materiel developer who initiated the QQPRI and subsequent QQPRIs, therefore, do not reflect combat developer recommendations.

- Procedures for amending QQPRI are undisciplined in the sense that they permit several iterations of a QQPRI to be in the "pipeline" simultaneously, thereby adding to the inherent confusion.

- Procedures for QQPRI and BOIP processing during competitive acquisition phases and during accelerated programs are not recognized as being different, thereby requiring special handling.

- The effect of Direct Productive Annual Maintenance Manhours (DPAMMH) reported in the QQPRI on the subsequent calculation of maintenance manpower requirements for a new materiel system is significant. yet, the materiel developer (usually a DARCOM subordinate command) who initiates a QQPRI is neither required to document the source(s) of such data nor to provide a definitive assessment of the validity of the information and the reliability of the methods by which it was obtained.

- Procedures require the combat developer (usually a TRADOC proponent school) who prepares a BOIP to include general rationale considered in determining the type and number of personnel needed to support the principal item. TRADOC, however, is neither required to document how critical maintenance manpower requirements were calculated nor to identify specific numerical variables, e.g., Manpower Authorization Criteria (MACRIT) factors, usage rates, and other non-numerical considerations, e.g., O&O concepts, used in the calculations. This kind of documentation is important, given the iterative nature of the BOIP document and the subsequent input of BOIP data into the Personnel Structure Accounting System (PERSACS), Manpower Analysis Papers (MAP),

Decision Coordinating Papers (DCP), and the Table of Organization and Equipment (TOE) development process.

## 2. Qualitative Manpower Requirements

There is no reliable standard set of tools/techniques for determining qualitative manpower requirements for new Army systems; however, a number of research initiatives are underway to develop such a methodology. Currently, Subject Matter Experts (SME) in the Army's materiel (DARCOM) and combat (TRADOC) development communities independently estimate qualitative requirements using a variety of criteria such as professional judgement; operational and maintenance experience with like or similar systems; the existing MOS structure; O&O concepts; and when available, task and skill analyses generated either by LSA or other similar processes. The qualitative estimation process is initiated by the materiel developer and documented in a QQPRI.

Each system studied required either the development of new operator and/or maintainer MOSs or significant modification of existing MOSs. For three of the systems -- MLRS, FIREFINDER, and the AN/TTC-39 Program -- qualitative requirements evolved through iterative analyses.

Only in the case of the UH-60A program did qualitative manpower requirements remain relatively unchanged from the first documented estimate made in the July 1976 QQPRI. That can be partially attributed to the following factors.

- Although the UH-60A replaces a similar system (UH-1), the Army aviation community (materiel and combat developers) recognized early that the technological advances reflected in the UH-60A design would require either extensive additional training of the UH-1 repairer or creation of a new MOS.

- The UH-60A specifications provided to contractors at the beginning of the engineering development phase were more detailed and specific than those normally given to new system contractors.

- Most UH-60A Subject Matter Experts (SME) in both the materiel (DARCOM) and Combat (TRADOC) development communities had significant prior aviation experience and familiarity with the overall personnel structure of the aviation community. In other words, the Army aviation acquisition community participants had more in common with each other in terms of training and experience than is generally the case with other types of systems.

- A task and skill analysis was performed by the contractor and documented in 1974; it provided a reasonable basis for government estimates of qualitative requirements in the July 1976 QQPRI.

The FIREFINDER radars and the AN/TTC-39 Program switches, like the UH-60A helicopter, are replacements for similar systems, and also reflect significant advances in technology. However, neither program sensed early the impact that technology would have on qualitative manpower requirements; both initially envisioned the use of the same unmodified MOSs as those being used for operating and maintaining the predecessor equipment. A number of factors summarized below, contributed to early uncertainties concerning qualitative requirements.

- Early qualitative estimates were based primarily on experience with like and similar systems rather than a task and skill analysis generated by the LSA or similar analytic process, which, theoretically, would have been a more accurate predictor.

- The LSA process as we know it today was just beginning to be implemented during the early FIREFINDER and AN/TTC-39 program acquisition stages. That, combined with low funding of FIREFINDER LSA during the same period and eventual stoppage of AN/TTC-39 program LSA, precluded the use of any reliable qualitative tools besides professional judgement and prior experience with similar systems.

- The first FIREFINDER operational test (AN/TPQ-37) in 1975 did not evaluate soldier-machine interface in sufficient detail to discover any mismatch between existing skills and those needed to operate and maintain the new equipment.

- The first serious analysis of AN/TTC-39 program qualitative personnel requirements was made during the initial operational test and evaluation of the switches. Such testing did not begin until June 1979, some 6½ years after program start and 4 years after the first QQPRI was prepared.

- Army manpower planners in the combat development (TRADOC) and personnel (MILPERCEN/DCSPER) communities did not actively participate in the qualitative manpower determination process during the early acquisition phases. Early qualitative predictions and materiel developer/contractor input to preliminary QQPRIs went essentially unnoticed, unanalyzed, and consequently, unchallenged by the manpower planners.

Although the MLRS is a new rather than a replacement system, the acquisition community initially looked to existing Career Management Fields (CMF) to find appropriate operator and maintainer MOSs. There were a number of changes in proposed MOSs until it became clear that a separate MLRS Crewman MOS was the best approach. Fluctuation in the qualitative requirements can be partially attributed to factors cited below.

- A detailed operational and organizational concept was not available until late in the development process.

- The maintenance concept was changed late in the development process.

- o Combat development proponency responsibilities were fragmented among five different TRADOC schools.
- o Indecision concerning operator and maintainer MOSs was prolonged by failure of the personnel community to become involved early in the process.

3. Quantitative Manpower Requirements

The tools and techniques for determining quantitative manpower requirements for new Army materiel systems are no more standard or analytically sound than those in use for estimating qualitative needs. Quantitative estimation techniques currently in use include professional judgement, particularly for operator positions; operational and maintenance experience with like or similar systems; O&O concepts, including usage and displacement rates; and for maintenance requirements, Direct Productive Annual Maintenance Manhours (DPAMMH), either estimated or generated by the Logistic Support Analysis (LSA) process, in combination with factors provided in AR 570-2, Manpower Authorization Criteria (MACRIT).

The quantitative process, like the qualititative, is initiated by the materiel developer (usually a subordinate Materiel Development/Readiness Command (MDC/MRC) within DARCOM, e.g., CECOM in the case of the AN/TTC-39 Program) through preparation of a QQPRI. Quantitative inputs to the QQPRI by the MDC/MRC include an estimate of direct operators needed to make up a single shift crew, and DPAMMH by MOS and level of maintenance for each system component and Associated

Support Items of Equipment (ASIOE). Except for the direct crew size, the materiel developer usually makes no independent estimate of quantitative manpower requirements. The combat developer (usually a proponent school within TRADOC) makes the quantitative estimate using data from the QQPRI, and employing some combination of the nonstandard tools listed above. The quantitative estimate is then documented in a BOIP which, among other things, lists changes in manpower by MOS and grade required in each Army organization slated to receive the system.

Determination of the number of direct system operators is generally a fairly straightforward process accomplished without the aid of sophisticated analytical tools. In fact, crew size is often either specified in the system requirement document, e.g., UH-60A BLACKHAWK, or implied in system specifications, e.g., MLRS.

The more difficult and critical task is the determination of quantitative maintenance and support manpower requirements. The Army has a formula, presented in Army Regulation (AR) 570-2, Manpower Authorization Criteria (MACRIT), which generally is used to calculate quantitative maintenance requirements. The formula, simply stated is:

$$A = \frac{BxCxD}{E}$$

where "A" equals the number of maintainers required; "B" is the Direct Productive Annual Maintenance Manhours (DPAMMH)

per item reported in the system QQPRI for a given MOS and level of maintenance; "C" is an indirect productive time factor of 1.4 given in AR 570-2, although a lower number can be used if justified; "D" is the equipment density based on the planned employment of the system; and "E" is the Available Annual Productive Manhours (AAPMH), a factor also provided in AR 570-2 which varies depending on the type of unit to receive the equipment.

Interviews with Subject Matter Experts (SME) who have been involved in using LSA data and MACRIT factors to calculate manpower requirements for new materiel systems revealed that there are some fundamental problems with using this formula. First, there is a general mistrust of the indirect productive time and AAPMH factors provided in AR 570-2. While the AR permits the planner some latitude in using these factors, there is no consistent methodology suggested as to how they should be applied to new system MOSs.

Secondly, and most important, there is a general lack of confidence among planners in the DPAMMH reported in the QQPRI and usually generated by LSA. Several instances were identified during this study effort where reported DPAMMH, when used in MACRIT formulas, were too low to yield a single space requirement for some maintenance MOSs. Early LSA estimates are understandably low because system design has not been frozen, all associated items of equipment generally have not

yet been identified, and only minimal engineering data has been collected. Beyond these obvious contributing factors, there is also skepticism about the basic validity of the Logistic Support Analysis Record (LSAR) data and the manner in which it is collected. A number of SMEs believed, but could offer no specific supporting evidence, that LSAR data are often skewed by a contractor's desire to present the most optimistic information possible, particularly during a competitive phase. Some materiel developers interviewed during this effort opined that the lack of a standard and sufficiently detailed methodology for industry to use in developing DPAMMHs is a root cause of the problem. Another contributing factor cited by a number of materiel developers is that the Army lacks sufficient resources (money, qualified manpower, and time) to perform substantive on-site validation of contractors' analyses which produce DPAMMH data as part of the LSA process.

A general lack of confidence in early LSA and MACRIT data led planners for some of the systems studied to and apply their own numerical "factors," e.g., MLRS and UH-60A. While this showed commendable initiative, it also illustrated the lack of a consistent methodology for determining quantitative requirements. In the case of the UH-60A, it also led to the uncoordinated use of several different "factors" in calculating MOS 67T requirements; each "factor" yielded a different MOS 67T personnel requirement for the same notional unit.

### C. HUMAN FACTORS ENGINEERING (HFE)

Army Regulation (AR) 602-1, Human Factors Engineering Program, 15 February 1983, prescribes policies and procedures and assigns responsibilities for HFE in the Department of the Army. Earlier versions, i.e., 4 March 1968 and 1 June 1976, were in effect during the major portions of the acquisition process for all four of the systems examined during this study. All stressed the importance of using HFE throughout the acquisition cycle to integrate materiel development with personnel resources and capabilities. The 1976 version additionally required that a HFE analysis (HFEA) be conducted during the validation phase of system development. The latest version expands that requirement by requiring an HFEA to be performed at the end of each of the first three phases; for detailed HFE guidance, it refers the reader to Military Specification (MIL-H-) 46855, Human Engineering Requirements for Military Systems, Equipment and Facilities and Military Standard (MIL-STD-) 1472, Human Engineering Design Criteria for Military Systems, Equipment, and Facilities.

Of the four systems studied, the MLRS Program made the strongest formal effort to integrate HFE into the overall system engineering and development process. While MLRS has not totally avoided man-machine interface problems, evidence gathered during this study indicates that it has had relatively fewer such difficulties than the other systems, except

for UH-60A. This is believed to be attributable to a combination of following factors.

- o The Special Study Group (SSG) identified MPT requirements/constraints during the Conceptual Phase.
- o Emphasis was placed on Performance of HFE in the Validation phase Request for Proposals (RFP) and subsequent contract.
- o An operational test (OT I) was conducted as part of the competitive process.
- o Funding of HFE support by the U.S. Army Human Engineering Laboratory (HEL) Detachment, collocated with the U.S. Army Missile Command, was provided throughout the Validation Phase and has continued to date.

Although there have been and still are soldier-machine interface problems with the MLRS system, many have to do with the compatibility between Government Furnished Equipment (GFE) and the MLRS system itself. In other words, they are problems over which MLRS team members have not had complete control.

Another system studied which has demonstrated good soldier-machine interface is the BLACKHAWK (UH-60A) Helicopter. However, not all the factors which contributed to those good results are the same as those found in the MLRS program. The UH-60A is a replacement aircraft for the UH-1. As such, the Army's aviation community had definite ideas about how it should be designed. Consequently, the aircraft specifications addressed in the RFP were quite detailed, and particular emphasis was placed on Reliability, Availability

and Maintainability (RAM) criteria. The RFP and subsequent competitive engineering development contract specifically called for performance of HFE. However, evidence examined during this study indicates that the detailed design specifications and stringent yet realistic RAM criteria furnished to competing contractors had greater impact on ensuring good soldier-machine interface than any direct HFE efforts.

No evidence was found that HEL provided any direct support to the UH-60A acquisition program; the UH-60A PM did, however, employ an effective technique for monitoring system design during the early stages of the Engineering Development Phase. Soldiers from Army aviation units in the field examined and critiqued design of prototype mock-ups in each competing contractor's factory. While no formal documentation of this effort could be found, personnel having knowledge of the program agreed that it provided valuable feedback to system engineers early enough to have an impact on design of the aircraft. As in the MLRS Program, the fact that an Operational Test was conducted as part of the competitive process also contributed to good soldier-machine interface.

In contrast to the MLRS and UH-60A Programs, the AN/TTC-39 Program has been plagued by soldier-machine interface problems. Neither the initial system requirement document nor the competitive Validation Phase RFP/contract addressed MPT requirements or constraints in any definitive

way. Little emphasis was placed on HFE during design of competitive prototypes, and validation testing was performed by the contractors; no operational government testing was conducted until the end of the Engineering Development Phase.

While the Engineering Development contract called for General Telephone and Electronics (GTE), the winning contractor, to perform HFE, and the PM funded HEL to guide and monitor GTE's HFE work in this phase, the contract requirements were too general to motivate strong corporate emphasis. Despite the best efforts of HEL and what was regarded by HEL to be competent human factors engineering at GTE, the final overall design of the system, begun in the previous phase, was little influenced by HFE considerations.

Some of the same soldier-machine interface problems identified to GTE by HEL early in the Engineering Development Phase (1975-76), were still being cited as deficiences during various government tests (DT, OT & RDAT) conducted between June 1978 and May 1980. In large measure, this is attributable to the following factors:

- o Lack of HFE emphasis and failure to include well defined MPT requirements/constraints or RAM criteria in the Validation Phase RFP and competitive contract.
- o Failure to conduct any operational testing during the competitive Validation Phase.
- o Failure to include strong, precise, and binding HFE requirements in the Engineering Development contract.

In case of both FIREFINDER radars, the statements of materiel need (MN) addressed a number of MPT requirements/

constraints such as crew size; ease of operation and organizational maintenance; and specific RAM criteria. Had these factors been as definitively addressed in RFPs and contractual documents, and stressed during the source selection process, Human Factors Engineering may have influenced design of both radars. Unfortunately, that did not happen, and HFE took a backseat in terms of both government effort and contract dollars during critical development phases. Primary emphasis in contractual documents was on technical performance and Design-to-Unit Production Costs. Although the FIREFINDER PM funded a one-half manyear per year HEL effort for each of three years from 1976 to 1979 to guide and assist the contractor in performance of HFE, the contractor was not motivated to do any more than the absolute minimum under the contract.

Comments concerning HFE in the DT III Report by The U.S. Army Test and Evaluation Command (TECOM) illustrate the effect of a weak HFE effort in design of the AN/TPQ-37. The system was found to be unsafe to operate, dangerous to maintain, and plagued by other HFE problems. Since the Army Materiel Systems Analysis Activity (AMSAA), in its DT III Independent Evaluation Report (IER), concluded that the HFE problems do not preclude fielding, it may be sometime after fielding the AN/TPQ-37 before the full impact of a weak HFE effort on the quality of solder-machine interface can be fully assessed.

## D. DETERMINATION OF TRAINING REQUIREMENTS

Estimating the training requirements for any new Army materiel system is generally done by two or more schools within the Training and Doctrine Command (TRADOC). Such joint effort is normally required, because each school has MOS training proponency for a limited number of specified career management fields (CMF), and operation and maintenance of a new system may require skills from several CMFs. One school is designated the proponent for training on a new system and, as such, coordinates and consolidates training requirements identified by other schools.

Consolidated requirements for all MOSs needed to operate and maintain a new system are then added to the system QQPRI. They are also documented in an Individual and Collective Training Plan (ICTP), which is normally prepared by the designated proponent school and updated as more information becomes available concerning the new system. Training requirements are further reported in the Army Modernization Information Memorandum (AMIM) for each major system.

Training that initially transfers knowledge about a new system from the materiel developer to the materiel users, supporters, and trainers is referred to as New Equipment Training (NET). For this one-time training effort, a plan (NETP) is also prepared (usually by a subordinate command in DARCOM) and coordinated with TRADOC and other major Army commands slated to receive initial quantities of the equipment.

The study effort examined how well the new-system training requirements determination process functioned during acquisition of four specific materiel systems. That limited assessment indicated that the process itself is generally adequate for the task of determining and documenting basic requirements. Improvements may be possible by either eliminating or at least reducing redundancies within the several requirements documents being generated within the acquisition community for each system.

Most training problems identified during this effort were traceable to difficulties in determining definitive manpower requirements (primarily qualitative). Such problems generally fell into one of the following categories:

- o The lack of a sufficiently detailed task and skill analysis to permit the accurate matching of proposed duty positions to existing MOSs caused delays in training as well as initial overtraining/undertraining of some MOSs. In one case (AN/TTC-39 Program), specific duty position/MOS matches, were recommended without the benefit of a task and skill analysis. Later testing proved these matches to be inappropriate, thereby negating initial training efforts and requiring major modification of subsequent training.
- o Prolonged indecision as to whether to create a new MOS or award an ASI to an existing one often delayed the training planning process, e.g., MLRS & FIREFINDER.
- o Either the lack of or frequent changes to organizational, operational, and/or maintenance concepts caused delays and turbulence in the training process for some systems, e.g., AN/TTC-39 Program & MLRS.

## SECTION IV

## CONCLUSIONS AND RECOMMENDATIONS

### A. LIFE CYCLE SYSTEM MANAGEMENT MODEL (LCSMM)

#### 1. Conclusion

Key Manpower, Personnel, and Training (MPT) events for a "traditional" acquisition Program are clearly identified in the LCSMM (DA PAM 11-25) and are generally well sequenced to permit a logical and timely assessment of MPT requirements.[11] However, MPT planners lack the procedural guidance and organizational flexibility needed to make accurate and timely assessments of requirements when major Army materiel acquisition programs are accelerated; this problem is particularly acute when whole development phases, which include important MPT events, are bypassed.

#### 2. Recommendation

Using the general LCSMM in DA PAM 11-25 as a guide, a system specific LCSMM should be jointly developed by the combat and materiel developers, and formally included as a part

[11]There are at least two exceptions to logical sequencing of MPT events in DA PAM 11-25. (1) The Final BOIP (FBOIP) and Final QQPRI (FQQPRI) are shown as occurring after DSARC III instead of more appropriately happening before that decision. (2) The FBOIP is shown as being completed and approved ahead of the FQQPRI; since the FBOIP derives certain data from the FQQPRI, this sequence should be reversed.

of each major system Letter of Agreement (LOA); it should specifically account for and realistically sequence MPT events judged essential by combat developers and manpower planners. Any subsequent major modifications in the acquisition strategy for that system should be formally agreed to by all parties to the original LOA.

## B. QQPRI AND BOIP PROCESSES

### 1. Conclusions

a. While the QQPRI and BOIP processes have been improved by policies outlined in the new AR 71-2, effective July 1982, they remain complex, cumbersome, and not well understood by their diverse participants. Decentralized vertical management of both processes contributes to document inaccuracies and system inefficiencies.

b. Procedural guidance concerning development of data for and preparation of the QQPRI and BOIP is inadequate for the large number of personnel, widely separated organizationally and geographically, who must either make inputs to or review contents of both.

### 2. Recommendations

a. The QQPRI, BOIP, and subsequent AURS/TOE development processes should be subjected to detailed management

analyses.[12] The purpose of such an effort would be to identify specific inefficiences and to develop procedures, within the existing organizational structure,[13] for streamlining, strengthening, and coordinating the various Army manpower requirements determination efforts. For example, it may be more realistic and efficient to have the materiel developer, who initiates the QQPRI, provide a detailed task and skill analysis and DPAMMH (LSA outputs) as input and leave the MOS determination effort entirely to the combat developer, also as an input. This approach may also have a bonus effect of promoting better communication between combat and materiel developers, fostered by a mutual dependence for information and support.

b. A *HQDA Technical* Bulletin or Pamphlet, which describes the QQPRI and BOIP processes in detail, should be published. Using such tools as decision logic tables, flow charts, and/or hypothetical examples, it should identify

[12]This report and the four case studies which support it describe and assess the MPT requirements determination process only in the context of developing four specific systems. While some systemic problems have become apparent through this effort, an in-depth/breadth examination of the QQPRI/ BOIP process was beyond the scope of this study.

[13]Other similar studies have stressed the need for a central manpower management entity, equipped with the authority and necessary resources to provide guidance to and resolve disagreements among manpower planners throughout the system on a realtime basis. The findings of this study effort support that assessment, but also recognize that establishment of such a horizontal management system in the short term is not a practical solution.

participants, fix responsibility for specific data inputs, and simplify/correlate the numerous steps. Such a document should also provide guidance as to acceptable techniques and tools that can be used to develop data required by each process, particularly in the area of calculating maintenance manpower requirements for BOIPs and subsequent TOEs; a requirement and rules for documenting how the calculations were made ought to be included. A model for such a guide is the RAM Rationale Annex Handbook, published by the U.S. Army Logistics Center in March 1980.

c. An orientation course concerning the QQPRI and BOIP systems should be designed and taught at least once annually to actual participants in both processes. It should include a comprehensive description of both processes and the MPT decisions affected by each. Most importantly, it should clearly illustrate the interdependence of steps in each and between both processes, and describe the important effects that the quality of an input at the beginning of a process can have on its ultimate outputs.

## C. HUMAN FACTORS ENGINEERING (HFE)

### 1. Conclusions

a. The Army has sufficient in-house HFE expertise, e.g., U.S. Army Human Engineering Laboratory (HEL) to advise and assist major acquisition Program Managers (PM) in monitoring

and evaluating how well a contractor is applying HFE in the total system design effort. However, the use of that expertise is neither mandated nor automatically funded.

b. The Army has no consistent methodology for ensuring that definitive and binding HFE criteria and taskings are developed, revised, and included in RFPs and system development contracts. Existence of in-house HFE expertise and a decision to use it are of little value if RFP/contractual language concerning its performance is not sufficiently clear, detailed, and motivating.

2. Recommendations

a. Funding and employment of in-house HFE expertise by major system PMs to monitor, evaluate, and interface with contractor HFE efforts, particularly during early stages of development, should be mandated.

b. Using MIL-STD 1472 and MIL-H-46855B as guides, the Army should establish procedures for generating definitive HFE criteria and taskings, perhaps tailored to specific types of materiel development projects. Such procedures should be an integral part of the preparation of all major system RFPs and development contracts and should assign specific responsibility for preparing RFP/contract HFE inputs. The procedures should also establish a means for assessing the adequacy of those inputs which includes review by appropriate

combat development and personnel community representatives, e.g., SSC-NCR and DSCPER.

D. TRAINING REQUIREMENTS

1. Conclusions

a. Estimates of training requirements for new systems are closely linked to predictions of the manpower (especially qualitative) required to operate and maintain them. Within the Army's acquisition community, TRADOC proponent schools are in the best position, functionally and organizationally, to make both appraisals, assuming that task and skill analyses have been provided by the appropriate materiel developers. TRADOC schools are responsible for managing the dynamics affecting MOSs in the CMFs for which they are proponent, e.g., other new systems planning to use the same MOS(s); effects of adding new system responsibilities to the existing MOS(s); training shortfalls reported by field units; CMF restructuring studies; and difficulties in meeting training projections (inputs or output).

b. A number of documents which address new materiel system training are generated by the Army acquisition community for each major system under development, e.g., NETP, ICTP, "Trainer" input to the QQPRI, and Army Modernization Information Memorandum (AMIN). While each serves a slightly different purpose and audience, there is enough redundancy among them to question the value of producing all of them in their current formats.

2. Recommendations

a. Combat developers (appropriate TRADOC proponent schools) should be given full responsibility for making specific estimates of qualitative manpower requirements concurrent with their predictions of training requirements for major new materiel systems.

b. Various documents concerning training requirements, currently being prepared by the Army acquisition community for each new material system, should be reviewed to determine if some reports could be either simplified or eliminated.

## E. GOVERNMENT TEST AND EVALUATION

1. Conclusion

Government evaluation (especially operational testing (OT)), of a new materiel system is the most effective means of assessing the quality of interface between soldier and machine prior to fielding. Currently, OT is also the best method the Army has of judging the validity of its manpower (quantitative and qualitative) and training requirements estimates for a system under development. Consequently, the earlier in the acquisition process that such testing can be started, (i.e., before DSARC II for major systems), the greater the resources and opportunities will be for correcting identified deficiencies. Testing in support of DSARC III has little chance of influencing either the system

design or the acquisition strategy in light of pressures to proceed with production and to limit further research and development expenditures.

2. Recommendation

Regardless of the overall strategy adopted for developing and acquiring a major new system, some government operational testing should be mandated early enough in the acquisition process (before DSARC II) to stengthen the probability that soldier-machine interface considerations will have an influence on system design, and to permit earlier (therefore, less costly) modifications to be made in manpower and training requirements estimates.

## APPENDIX A

## MAJOR MPT RELATED REFERENCES

### POLICIES & PROCEDURES

#### Department of Defense

DoD Directive 5000.1, Major System Acquisition

DoD Directive 5000.39, Acquisition and Management Support for Systems and Equipment

DoD Instruction 5000.2, Major Systems Acquisition Process

ASD(MRA&L) Memorandum, "Manpower Analysis Requirements for System Acquisition", August 1978.

MIL-STD-1388 Logistic Support Analysis, October 1973

Proposed MIL-STD-1388A, Weapon System and Equipment Support Analysis, November 1981 (Draft)

MIL-STD-1472B, Human Engineering Design Criteria for Military Systems, Equipment, and Facilities, December 1974

MIL-H-46855B, Human Engineering Requirements for Military Systems, Equipment, and Facilities

#### Department of the Army

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| AR 1-1 | Planning Programming and Budgeting Within the Department of the Army |
| AR 10-4 | US Army Operational Test and Evaluation Agency |
| AR 10-5 | Department of the Army |
| AR 10-11 | US Army Materiel Command |
| AR 10-25 | US Army Logistics Evaluation Agency |
| AR 10-41 | US Army Training and Doctrine Command |
| AR 11-4 | System Program Reviews |
| AR 11-8 | Principles and Policies of the Army Logistic System |
| AR 15-14 | Systems Acquisition Review Council Procedures |
| AR 70-1 | Army Research, Development and Acquisition |
| AR 70-2 | Materiel Status Recording |

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| AR 70-10 | Test and Evaluation During Development and Acquisition of Materiel |
| AR 70-16 | Department of the Army System Coordinator (DASC) System |
| AR 70-27 | Outline Development Plan/Development Plan, Army Program Memorandum/Defense Program Memorandum/ Decision Coordinating Paper |
| AR 70-61 | Type Classification of Army Materiel |
| AR 71-1 | Army Combat Developments |
| AR 71-2 | Basis of Issue Plans |
| AR 71-3 | User Testing |
| AR 71-9 | Materiel Objectives and Requirements |
| AR 71-10 | Department of the Army Force Integration Staff Officer (FISO) System |
| AR 310-31 | Management System for Tables of Organization and Equipment (The TOE System) |
| AR 310-34 | Equipment Authorization Policies and Criteria, and Common Tables of Allowances |
| AR 310-49 | The Army Authorization Documents System (TAADS) |
| AR 350-1 | Army Training |
| AR 350-10 | Management of Army Individual Training Requirement and Resources |
| AR 350-35 | New Equipment Training and Introduction |
| AR 570-2 | Organization and Equipment Authorization Tables - Personnel |
| AR 602-1 | Human Factors Engineering Program |
| AR 511-1 | Military Occupational Classification Structure Development and Implementation |
| AR 611-201 | Enlisted Career management Field and MOSs |
| AR 70-18 | Provisioning of U.S. Army Equipment |
| AR 700-127 | Integrated Logistic Support |
| AR 702-3 | Army Materiel Reliability, Availability and Maintainability (RAM) |

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| AR 750-1 | Army Materiel Maintenance Concepts and Policies |
| AR 750-43 | Test, Measurement, and Diagnostic Equipment |
| AR 1000-1 | Basic Policies for Systems Acquisition |
| DA PAM 11-2 | Research and Development Cost Guide for Army Materiel Systems |
| DA PAM 11-3 | Investment Cost Guide for Army Materiel Systems |
| DA PAM 11-4 | Operating and Support Cost Guide for Army Materiel Systems |
| DA PAM 11-5 | Standards for Presentation and Documentation of Life Cycle Cost Estimates for Materiel Systems |
| DA PAM 11-25 | Life Cycle System Management Model for Army Systems |
| DA PAM 700-125 | Integrated Logistics Support (ILS) Management Model and Glossary |

Army Modernization Information (AMIN), 1979, 1980, 1981.

U.S. Army Training and Doctrine Command (TRADOC)

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| TRADOC Reg 11-1 | Manpower Analysis and Force Structuring in the Combat Development Process |
| TRADOC Reg 11-8 | Combat Development Studies |
| TRADOC Reg 71-9 | User Test and Evaluation |
| TRADOC Reg 71-12 | Total System Management - TRADOC System Manager (TSM) |
| TRADOC Reg 71-77 | Unit Reference Sheets |
| TRADOC Reg 350-4 | The TRADOC Training Effectiveness Analysis (TEA) System |
| TRADOC Cir 351-8 | ICTP for Developing Systems |
| TRADOC PAM 70-2 | DARCOM/TRADOC Materiel Acquisition HDBK, January 1980 |
| TRADOC PAM 351-4 | Job and Task Analysis Handbook, August 1979. |

U.S. Army Materiel Development and Readiness Command (DARCOM)

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| DARCOM HDBK 700-1.1-81 | ILS primer (1st and 2nd Editions) |
| DARCOM HDBK 700-2.1-81 | LSA, December 1981 |

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Bonder, Seth, A Review, of Army Force Modernization and Associated Manpower, Personnel, and Training Processes, Work Paper PUTA 81-2, ARI, January 1981.

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O'Connor, Francis E., et al, FIREFINDER -- A Case Study of MPT Requirements Determination, April 1983.

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## APPENDIX B

## GLOSSARY OF ACRONYMS

AAPMH--Available Annual Proddductive Manhours
AMIM--Army Modernization Information Memorandum
AMSAA--Army Materiel Systems Analysis Activity
AR--Army Regulation
ARI-- Army Research Institute for the Behavioral and Social Sciences
ASARC--Army System Acquisition Review Council
ASI--Additional Skill Identifier
ASIOE--Associated Support Items of Equipment
ATSC--Army Training Support Center
AURS--Automated Unit Reference Sheet
BLACKHAWK--UH-60 Utility Helicopter
BOIP--Basis of Issue Plan
BOIPFD--Basis of Issue Plan Feeder Data
CECOM--US Army Communications and Electronics Command
CMF--Career Management Field
DA--Department of the Army
DA PAM--Department of the Army Pamphlet
DARCOM--US Army Materiel Development and Readiness Command
DCP--Decision Coordinating Paper
DCSLOG--Deputy Chief of Staff for Logistics
DCSOPS--Deputy Chief of Staff for Operations and Plans
DCSPER--Deputy Chief of Staff for Personnel
DCSRDA--Deputy Chief of Staff for Research, Development, and Acquisition
DOD--Department of Defense
DPAMMH--Direct Productive Annual Maintenance Manhours
DS--Direct Support
DSARC--Defense System Acquisition Review Council
DSMC--Defense Systems Management College
DT--Developmental Testing
DT (I, II, III)-- Development Test (I, II, III)
EARA--Equipment Authorization Review Activity
FBOIP--Final Basis of Issue Plan
FIREFINDER--AN/TPQ-36 Mortar Locating Radar & AN/TPQ-37 Artillery Locating Radar
FQQPRI--Final QQPRI
FSED--Full Scale Engineering Development
GCT--Government Competitive Test
GFE--Government Furnished Equipment
GS--General Support
GTE--General Telephone & Electronics
HEL--US Army Human Engineering Laboratory
HFE--Human Factors Engineering
HFEA--Human Factors Engineering Analysis
HQDA--Headquarters, Department of the Army
ICTP--Individual and Collective Training Plan
IER--Independent Evaluation Report
IOC--Initial Operational Capability

ISI--Information Spectrum, Inc.
LCSMM--Life Cycle System Management Model
LOA--Letter of Agreement
LOGCEN--US Army Logistics Center
LSA--Logistic Support Analysis
LSAR--Logistic Support Analysis Record
MACRIT--Manpower Authorization Criteria
MAP--Manpower Analysis Paper
MDC--Materiel Development Command
MICOM--US Army Missile Command
MIL-H--Military Specification
MILPERCEN--US Army Military Personnel Center
MIL-STD--Military Standard
MLRS--Multiple Launch Rocket System
MN--Materiel Need
MOS--Military Occupational Specialty
MPT--Manpower, Personnel, and Training
MRC--Materiel Readiness Command
MRSA--US Army Materiel Readiness Support Activity
NET--New Equipment Training
NETP--New Equipment Training Plan
O&O-- Operational & Organizational
OT--Operational Testing
OT (I, II, III)--Operational Test (I, II, III)
OTEA--US Army Operational Test and Evaluation Agency
PERSACS--Personnel Structure and Composition System
PM--Program Manager
PM-TRADE--Training Devices Program Manager
QQPRI--Qualitative and Quantitative Personnel Requirements Information
RAM--Reliability, Availability, and Maintainability
RFP--Request for Proposal
SGA--Standards of Grade Authorization
SME--Subject Matter Expert
SMI--Soldier-Machine Interface
SOW--Statement of Work
SPAS--Skill Performance Aids
SQI--Special Qualifications Identifier
SSC-NCR--Soldier Support Center - National Capital Region
SSEB--Source Selection Evaluation Board
SSG--Special Study Group
TECOM--US Army Test and Evaluation Command
TMDE--Test, Measurement, and Diagnostic Equipment
TOE--Table of Organization and Equipment
TRADOC--US Army Training and Doctrine Command
TSM--TRADOC System Manager